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10/800,493	03/15/2004	Stephen Fife Sheldon	11466	9307

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EXAMINER	
SANDERS, AARON J	
ART UNIT	**PAPER NUMBER**
2168	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/23/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/800,493	SHELDON ET AL.	
	Examiner	Art Unit	
	Aaron J. Sanders	2169	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 December 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-42* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-42* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

This Office action has been issued in response to amendment filed 15 December 2006. Claims 1-42 are pending. Applicant's arguments have been carefully and respectfully considered, and some are persuasive, while others are not. Accordingly, objections and rejections have been removed where arguments were persuasive, but rejections have been maintained where arguments were not persuasive. Accordingly, claims 1-42 are rejected, and this action has been made FINAL, as necessitated by amendment.

Specification

The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed. The following title is suggested: Performing SQL Query Optimization by Simplifying Sub-Expressions.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-3, 6-9, 11-17, 20-23, 25-31, 34-37, and 39-42 are rejected under 35 U.S.C. 102(e) as being anticipated by Paulley et al., U.S. Pat. 6,665,664.

As per claims 1-3, 6-9, 11-17, 20-23, 25-31, 34-37, and 39-42, Paulley et al. teach:

1. (Currently Amended) A method of processing a database query, the query including one or more expressions, the method including:

performing expression optimization on one or more of the expressions (See e.g. col. 7, lines 42-55, "a preprocessing phase, in which expressions are simplified whenever possible");

performing further query optimization (See e.g. col. 7, lines 42-55, "a normalization phase, in which the simplified expression is analyzed and either fully converted to conjunctive normal form");

where the expression optimization is performed before further query optimization (See e.g. col. 7, lines 42-55, "This preprocessing phase includes several steps that are designed to simplify the original query expression, thereby simplifying the matrix processing occurring in the normalization phase"); and

where each expression includes one or more sub-expressions, and where the expression optimization includes, for each expression (See e.g. col. 13, lines 1-13, "The present invention repeatedly generates prime implicates of disjunctive sub-expressions nested within a conjunctive expression, thereby normalizing the search condition piece-by-piece"):

(1) if the expression has a form selected from the group consisting of "SE+0," "SE*1," and "SE/1," where SE is a sub-expression, then reducing the expression to SE (See e.g. col. 13, lines 50-64, "simplifies the expression by eliminating tautologies (statements that are always true) and simplifying predicates and operator conditions as follows: (a) Folding constant expressions when the expressions contain integers (e.g., x=3+4 is changed to x=7) and the columns referenced in the statement are numeric"

where "SE+0," "SE*1," and "SE/1" are tautologies because "SE+0," "SE*1," and "SE/1" always equal "SE", and therefore the statements, e.g. SE+0 = SE, are always true).

As per claims 2, 16, and 30: (Currently Amended) The method of claim 1, where each expression includes one or more sub-expressions, and where the expression optimization includes, for each expression:

(2) if the expression has a form selected from the group consisting of "SE*0," "0/SE," and "0 MOD SE," where SE is a non-nullable sub-expression, then reducing the expression to 0; and

(3) if the expression is of the form F(C), where F is a function and C is a constant and F(C) returns a return value, then reducing the expression to the return value (See e.g. col. 13, lines 50-64, "simplifies the expression by eliminating tautologies (statements that are always true) and simplifying predicates and operator conditions as follows: (a) Folding constant expressions when the expressions contain integers (e.g., x=3+4 is changed to x=7) and the columns referenced in the statement are numeric" where "SE+0," "SE*1," "SE/1," "SE*0," "0/SE," and "0 MOD SE" are tautologies and "x=3+4" is a function in the form "F(C)").

As per claims 3, 17, and 31: (Original) The method of claim 2, where one or more of the sub-expressions include sub-expressions, the method including;

(4) for each sub-expression that includes a sub-expression, simplifying the sub-expression using (1)-(3) (See e.g. col. 13, lines 1-13, "The present invention repeatedly generates prime implicates of disjunctive sub-expressions nested within a conjunctive expression, thereby normalizing the search condition piece-by-piece").

As per claims 6, 20, and 34: (Original) The method of claim 1, where the query is represented by a tree, including one or more nodes (See e.g. col. 11, lines 56-65, "the SQL statements are passed to the parser 361 which converts the statements into a query tree").

As per claims 7, 21, and 35: (Original) The method of claim 1, where the query includes an assignment list clause and where one or more of the expressions are in the assignment list clause (See e.g. col. 18, lines 37-54, "A linked list of pointers is used to track which branches in the expression tree should be converted").

As per claims 8, 22, and 36: (Original) The method of claim 1, where the query includes a WHERE clause, and where one or more of the expressions are in the WHERE clause (See e.g. col. 2, Table 1, "SELECT name FROM employees WHERE sal=10,000").

As per claims 9, 23, and 37: (Original) The method of claim 1, where further query optimization includes:

determining a satisfiability of the database query (See e.g. col. 2, lines 55-63, "Conjunctive conditions are useful because they must each evaluate to true in order for the query's Where clause to be satisfied").

As per claims 11, 25, and 39: (Original) The method of claim 1, where further query optimization includes:

determining one or more plans for executing the query (See e.g. col. 2, lines 37-54, "a component called the optimizer determines the "plan" or the best method of accessing the data to implement the SQL query").

As per claims 12, 26, and 40: (Original) The method of claim 11, where one of the one or more plans includes:

scanning a table to locate rows that satisfy one or more conditions; and

summing one or more columns in the rows that satisfy the one or more conditions (See e.g. col. 4, lines 11-43, "The usefulness of converting the search conditions to conjunctive normal form is that for a clause that consists of only a single predicate (i.e., not "ORed with anything"), for any row in the result of that query that predicate must be true" where then summing the columns would have the same "true" result).

As per claims 13, 27, and 41: (Original) The method of claim 1, where further query optimization includes:

selecting an optimal plan from executing the database query (See e.g. col. 12, lines 7-16, "The optimizer, therefore, performs an analysis of the query and picks the best execution plan, which in turn results in particular ones of the access methods being invoked during query execution").

As per claims 14, 28, and 42: (Original) The method of claim 1, where further query optimization includes two or more optimizations selected from the group consisting of:

determining a satisfiability of the database query (See e.g. col. 2, lines 55-63, "Conjunctive conditions are useful because they must each evaluate to true in order for the query's Where clause to be satisfied");

determining a transitive closure of the database query;

determining one or more plans for executing the query (See e.g. col. 2, lines 37-54, "a component called the optimizer determines the "plan" or the best method of accessing the data to implement the SQL query"); and

selecting an optimal plan from executing the database query (See e.g. col. 12, lines 7-16, "The optimizer, therefore, performs an analysis of the query and picks the best execution plan, which in turn results in particular ones of the access methods being invoked during query execution").

15. (Currently Amended) A computer program, stored on a tangible storage medium, for use in processing a database query, the query including one or more expressions, the computer program including executable instructions that cause a computer to (See e.g. Fig. 2):

perform expression optimization on one or more of the expressions (See e.g. col. 7, lines 42-55, "a preprocessing phase, in which expressions are simplified whenever possible");

perform further query optimization (See e.g. col. 7, lines 42-55, "a normalization phase, in which the simplified expression is analyzed and either fully converted to conjunctive normal form");

where the expression optimization is performed before further query optimization (See e.g. col. 7, lines 42-55, "This preprocessing phase includes several steps that are designed to simplify the original query expression, thereby simplifying the matrix processing occurring in the normalization phase"), and where the computer program including executable instructions that cause a computer to, for each expression (See e.g. col. 13, lines 1-13, "The present invention repeatedly generates prime implicates of disjunctive sub-expressions nested within a conjunctive expression, thereby normalizing the search condition piece-by-piece"):

(1) determine if the expression has a form selected from the group consisting of "SE+0," "SE*I," and "SE/1," where SE is a sub-expression, and if so, then reduce the expression to SE (See e.g. col. 13, lines 50-64, "simplifies the expression by eliminating

tautologies (statements that are always true) and simplifying predicates and operator conditions as follows: (a) Folding constant expressions when the expressions contain integers (e.g., x=3+4 is changed to x=7) and the columns referenced in the statement are numeric" where "SE+0," "SE*1," and "SE/1" are tautologies because "SE+0," "SE*1," and "SE/1" always equal "SE", and therefore the statements, e.g. SE+0 = SE, are always true).

29. (Currently Amended) A database system including:

a massively parallel processing system including:

one or more nodes (See e.g. Fig. 3);

a plurality of CPUs, each of the one or more nodes providing access to one or more CPUs (See e.g. Fig. 3);

a plurality of data storage facilities each of the one or more CPUs providing access to one or more data storage facilities (See e.g. Fig. 3);

a process for execution on the massively parallel processing system for processing one or more database queries, each query including one or more expressions (See e.g. Fig. 3), the process including:

performing expression optimization on one or more of the expressions (See e.g. col. 7, lines 42-55, "a preprocessing phase, in which expressions are simplified whenever possible");

performing further query optimization (See e.g. col. 7, lines 42-55, "a normalization phase, in which the simplified expression is analyzed and either fully converted to conjunctive normal form");

where the expression optimization is performed before the further query optimization (See e.g. col. 7, lines 42-55, "This preprocessing phase includes several steps that are designed to simplify the original query expression, thereby simplifying the matrix processing occurring in the normalization phase"); and

where each expression includes one or more sub-expressions, and where the expression optimization includes, for each expression (See e.g. col. 13, lines 1-13, "The present invention repeatedly generates prime implicates of disjunctive sub-expressions nested within a conjunctive expression, thereby normalizing the search condition piece-by-piece"):

(1) if the expression has a form selected from the group consisting of "SE+0," "SE*I," and "SE/1," where SE is a sub-expression, then reducing the expression to SE (See e.g. col. 13, lines 50-64, "simplifies the expression by eliminating tautologies (statements that are always true) and simplifying predicates and operator conditions as follows: (a) Folding constant expressions when the expressions contain integers (e.g., x=3+4 is changed to x=7) and the columns referenced in the statement are numeric" where "SE+0," "SE*1," and "SE/1" are tautologies because "SE+0," "SE*1," and "SE/1" always equal "SE", and therefore the statements, e.g. SE+0 = SE, are always true).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 4, 18, and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Paulley et al. as applied to claims 1-3, 6-9, 11-17, 20-23, 25-31, 34-37, and 39-42 above, in view of Leung et al., U.S. Pat. 5,590,324.

As per claims 4, 18, and 32, Paulley et al. disclose the subject matter upon which the instant claims depend, but do not appear to disclose making a sub-expression nullable if it includes a nullable column. However, Leun et al. do make such a disclosure (See e.g. col. 7, lines 56-64, "if a head expression simply consists of a column C, then the output column retains the nullability of column C from its input derived table or base table"). Paulley et al. and Leung et al. are analogous art because they both deal with optimizing SQL queries. At the time of the invention, it would have been obvious to one of ordinary skill in the art to make sub-expressions nullable if they include a nullable column. The motivation for combining these features is disclosed by Leung et al. col. 1, lines 62-67, "The exploitation of column nullability can mean a potentially huge saving in query execution time".

Claims 5, 19, and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Paulley et al. as applied to claims 1-3, 6-9, 11-17, 20-23, 25-31, 34-37, and 39-42 above, in view of Andrei, U.S. Pat. 6,618,719.

As per claims 5, 19, and 33, Paulley et al. disclose the subject matter upon which the instant claims depend, but do not appear to disclose making a sub-expression nullable if it belongs to an inner table of an outer join. However, Andrei does make such a disclosure (See

e.g. col. 27, lines 44-47, "The ASE query engine's single outer join algorithm requires the inner table of the outer join to be also the inner table of the join, to substitute NULLs when no inner row qualifies for a given outer row" where, see col. 2, lines 57-59, "ASE" is an "Adaptive Server Enterprise" and rows are part of a "derived table--A table implemented as a stream of rows, representing the result of a relational operator"). Paulley et al. and Andrei are analogous art because they both deal with optimizing SQL queries. At the time of the invention, it would have been obvious to one of ordinary skill in the art to make a sub-expression nullable if it belongs to an inner table of an outer join. The motivation for combining these features is disclosed by Leung et al., U.S. Pat. 5,590,324, col. 1, lines 62-67, "The exploitation of column nullability can mean a potentially huge saving in query execution time".

Claims 10, 14, 24, 28, 38, and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Paulley et al. as applied to claims 1-3, 6-9, 11-17, 20-23, 25-31, 34-37, and 39-42 above, and further in view of Esko Nuutila, *Transitive Closure*, Helsinki University of Technology, 9 October 1995.

As per claims 10, 14, 24, 28, 38, and 42, Paulley et al. disclose the subject matter upon which the instant claims depend, but do not appear to disclose "determining a transitive closure of the database query". However, Nuutila does make such a disclosure (See below). Paulley et al. and Nuutila are analogous art because they both deal with parsing database queries. At the time of the invention, it would have been obvious to one of ordinary skill in the art to determine a transitive closure of the database query. The motivation for combining these features is disclosed by Nuutila, "It is required, for instance, in the reachability analysis of transition

networks representing distributed and parallel systems and in the construction of parsing automata in compiler construction".

10. The method of claim 1, where further query optimization includes:

determining a transitive closure of the database query (Nuutila, "The transitive closure of G is a graph G+ = (V,E+) such that for all v,w in V there is an edge (v,w) in E+ if and only if there is a non-null path from v to w in G").

14. The method of claim 1, where further query optimization includes two or more optimizations selected from the group consisting of:

determining a satisfiability of the database query (See e.g. Paulley et al. col. 2, lines 55-63, "Conjunctive conditions are useful because they must each evaluate to true in order for the query's Where clause to be satisfied");

determining a transitive closure of the database query (Nuutila, "The transitive closure of G is a graph G+ = (V,E+) such that for all v,w in V there is an edge (v,w) in E+ if and only if there is a non-null path from v to w in G");

determining one or more plans for executing the query (See e.g. Paulley et al. col. 2, lines 37-54, "a component called the optimizer determines the "plan" or the best method of accessing the data to implement the SQL query"); and

selecting an optimal plan from executing the database query (See e.g. Paulley et al. col. 12, lines 7-16, "The optimizer, therefore, performs an analysis of the query and picks the best execution plan, which in turn results in particular ones of the access methods being invoked during query execution").

Response to Arguments

As per Applicant's argument that Paulley et al. do not disclose simplifying sub-expressions, the Examiner respectfully disagrees and has further explained in the claim rejection above. Specifically, col. 13, lines 1-13 clearly state that Paully et al. generate sub-expressions: "The present invention repeatedly generates prime implicates of disjunctive sub-expressions nested within a conjunctive expression, thereby normalizing the search condition piece-by-piece".

As per Applicant's argument that "SE+0", "SE*1", and "SE/1" are not tautologies, the Examiner respectfully disagrees. A tautology is a statement that is always true. According to the instant claims, "SE+0", "SE*1", and "SE/1" are reduced to "SE". That means that "SE+0" equals "SE", "SE*1" equals "SE", and "SE/1" equals "SE". The statements are tautologies because "SE+0", "SE*1", and "SE/1" will always equal "SE" and are therefore always true. The value of "SE" is irrelevant; all that matters is that "SE+0", etc. will always equal "SE". The rejections have been further explained in the above claims.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period

will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Aaron J. Sanders whose telephone number is 571-270-1016. The examiner can normally be reached on M-Th 8:00a-5:00p.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Christian Chace can be reached on 571-272-4190. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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